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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 :		(11) International Publication Number:
H04Q 7/32, H04B 1/38, H04M 1/60	**A1**	**WO 00/42797**
		(43) International Publication Date: 20 July 2000 (20.07.00)

(21) International Application Number: PCT/US00/00662

(22) International Filing Date: 11 January 2000 (11.01.00)

(30) Priority Data:
09/229,131 12 January 1999 (12.01.99) US

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(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

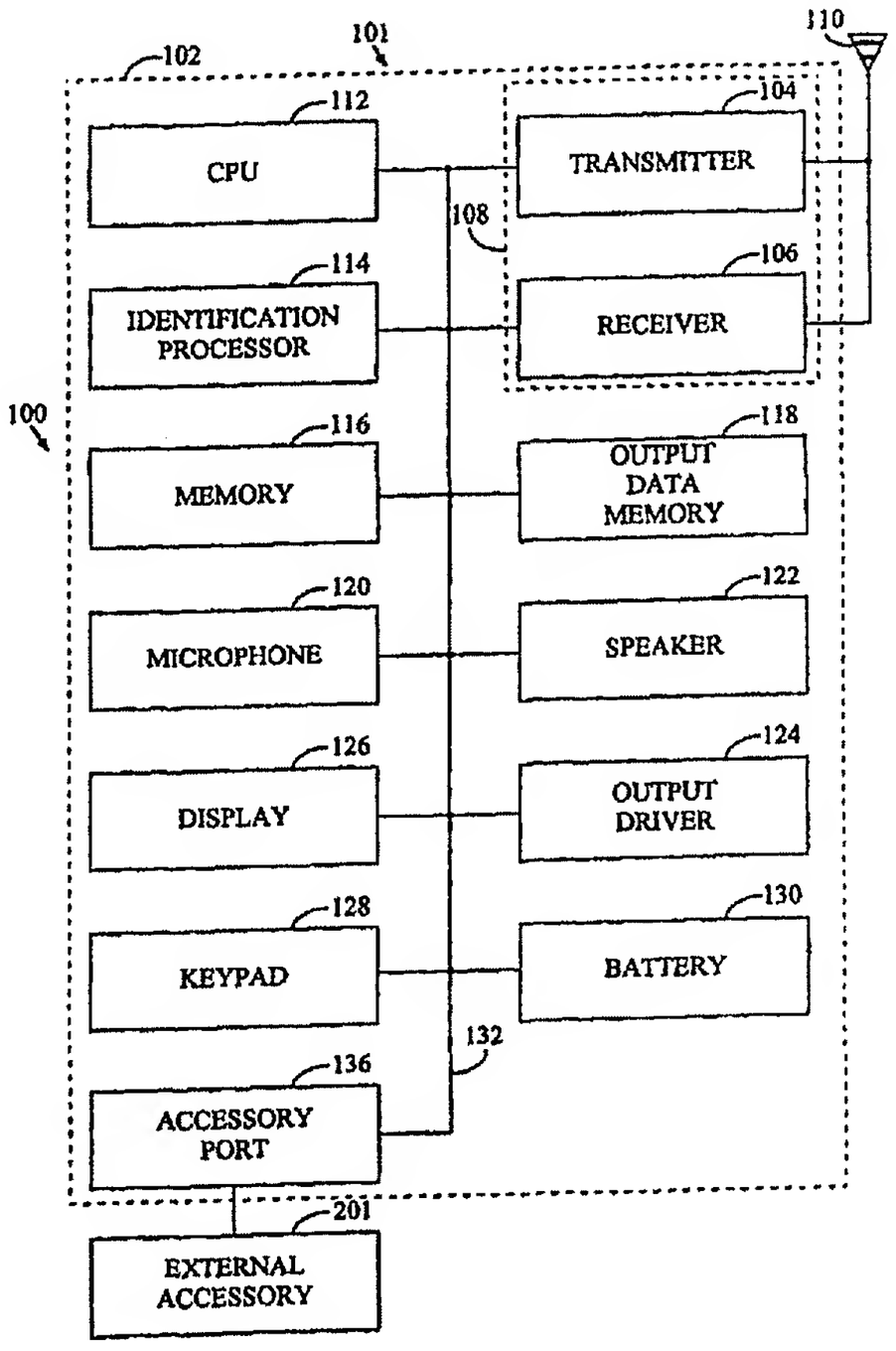
Published

With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: SYSTEM AND METHOD FOR THE AUTOMATIC IDENTIFICATION OF ACCESSORIES COUPLED TO A WIRELESS COMMUNICATION DEVICE

(57) Abstract

A wireless communication device (100) having an accessory port (136) and a processor (114) to detect when an external accessory (201) is coupled to the accessory port, and then identify the type of external accessory. A data line (208) connects the external accessory to the wireless communication device, the data line being a portion of a pulse code modulation (PCM) port in the accessory port. The processor senses activity on this data line, including a signal transmitted by the external accessory indicative of when the external accessory is coupled to the wireless communication device. The processor further senses identification data associated with the external accessory, with the identification data including an identification code of the external accessory. The processor generates a clock signal, and the external accessory transmits the identification data to the wireless communication device over the data line in response to the clock signal. In this fashion, the processor repeatedly senses the transmitted identification data. An input line in the accessory port carries a voltage indicative of whether the external accessory supplies external power to the wireless communication device. The identification code transmitted by the external accessory is compared to stored codes corresponding to a plurality of external accessories to identify the external accessory coupled to the wireless communication device.



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SYSTEM AND METHOD FOR THE AUTOMATIC IDENTIFICATION OF ACCESSORIES COUPLED TO A WIRELESS COMMUNICATION DEVICE

FIELD OF THE INVENTION

The present invention is related generally to wireless communication devices and connectable external accessories, and more particularly, to a system and method for detecting when an external accessory has been connected to the wireless communication device and for identifying the type of external accessory connected.

BACKGROUND OF THE INVENTION

Modern wireless communication devices, such as cellular telephones, are designed so that the user may connect external accessories to the cellular telephone, enabling the user to use the cellular telephone in a wider range of applications than if the cellular telephone were used by itself. For example, a headset accessory may be connected to some cellular telephones so that a microphone and earpiece are positioned in proximity of the user's mouth and ear, respectively, to permit hands-free operation of the cellular telephone. Another example of a common external accessory connectable to a cellular telephone is a carkit accessory that allows the cellular telephone to be used while driving an automobile without the inconvenience of holding the cellular telephone. The kit includes a microphone that can be attached to a convenient location within the automobile, and the kit is connected to the automobile's audio system so that the audible signals produced by the cellular telephone can be heard over the speakers of the audio system.

Other examples of common external accessory devices include a battery charger to recharge the internal battery of the wireless communication device and a computer interface that allows connection of a personal computer or

laptop to the wireless communication device via a PCMCIA (Personal Computer Memory Card International Association) interface. Numerous other types of external accessories are available. These external accessories are connected to the wireless communication device by an extension cord having a fitting at its end. An accessory port of the wireless communication device receives the fitting, and in this fashion, the external accessory is electrically and communicatively coupled to the wireless communication device.

However, for a variety of reasons, there is an ongoing need to find a satisfactory way for the wireless communication device to identify when an external accessory has been coupled to the accessory port and to identify the type of external accessory. For example, if the user of the wireless communication device wishes to increase the volume of a call, the wireless communication device will need to know if the volume adjustments being made by the user are being directed towards the wireless communication device internal speaker or to a speaker of an external accessory. Without this ability to identify when and what kind of external accessory is coupled, the user may be mistakenly increasing the volume of the internal speaker within the device, instead of the volume of the speaker of the external accessory that the user intended to adjust. The present invention provides solutions to these problems, as will be apparent from the following detailed description and accompanying figures.

SUMMARY OF THE INVENTION

The present invention is embodied in a system and method directed to sensing when an external accessory is coupled to a wireless communication device, and to identifying the type of external accessory. In one embodiment, the wireless communication device includes an accessory port that allows an external accessory to be coupled to the wireless communication device, the

accessory port including at least one data line, and a processor to sense activity on the data line when the external accessory has been coupled. The processor senses identification data associated with the external accessory to identify the external accessory.

In an exemplary embodiment, the data line is a portion of a pulse code modulation (PCM) port. The processor generates a clock signal coupled to the accessory port. The external accessory transmits identification data to the wireless communication device over the data line as determined by this clock signal.

In one embodiment, the phone detects activity on the data line as indicative of whether the external accessory is coupled to the wireless communication device. Also, the presence of voltage on an input line of the phone's accessory port is indicative of whether the external accessory provides power to the phone. The identification data includes an identification code of the external accessory. The processor identifies the type of external accessory by comparing the identification code with stored codes corresponding to a plurality of external accessories. The invention allows a wireless communication device to identify a carkit, headset, computer interface, battery charger, and other types of external accessories.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a functional block diagram of an exemplary embodiment of the wireless communication system of the present invention.

FIG. 2 illustrates the connection of two different external accessories to the system of FIG. 1.

FIG. 3 is a table listing identification data of several external accessories to the system of FIG. 1.

FIG. 4 is a table listing accessory interface keys that determine when an external accessory is coupled and that identify the type of external accessory coupled to the system of FIG. 1.

FIG. 5 is a flow chart illustrating how a processor of the system of FIG. 1 determines when an external accessory is coupled and identifies the type of external accessory coupled to the system of FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A wireless communication device needs to be able to identify when and what kind of accessory has been coupled to its accessory port. The present invention will be discussed here in terms of a cellular telephone. Although described herein as a cellular telephone, the principles of the present invention are applicable to a variety of wireless communication devices including, but not limited to, cellular/PCS, radio telephone, conventional radio, and the like. Accordingly, the present invention is not limited by the specific form of wireless communication device.

The present invention is embodied in a system **100** illustrated in the functional block diagram of FIG. 1. The system **100** includes a wireless communication device **101** and an external accessory **201**, two of which are illustrated in FIG. 2 as either a headset accessory **202** or a carkit accessory **210**. Although there are many other possible external accessories that may be connected to the wireless communication device **101**, in the interest of brevity, not all of them are shown or fully described herein. However, the absence of any description of these external accessories is not meant to limit the scope of the invention.

The wireless communication device **101**, which may be embodied in a cellular telephone, includes a housing **102** that contains a transmitter **104** and a receiver **106** to allow transmission and reception of data, such as audio

communications, between the system **100** and a remote location, such as a cell site controller (not shown). The transmitter **104** and receiver **106** may be combined into a transceiver **108**. An antenna **110** is attached to the housing **102** and electrically coupled to the transceiver **108**. The operation of the transmitter **104**, receiver **106**, and antenna **110** is well known in the art and need not be described herein.

The wireless communication device **101** also includes a central processing unit (CPU) **112**, which controls operation of the system **100**. The CPU **112** may perform all the tasks involved with the operation of the system **100**, or only a portion of them, where the remaining tasks are delegated to other processing units included in the system. For example, the wireless communication device **101** may include, in addition to CPU **112**, an identification processor **114** for receiving and processing identification data. The identification data reflects whether the wireless communication device **101** is connected to an external accessory, and identifies the specific external accessory if one is connected. The identification processor **114** and the identification data will be described in greater detail below.

The wireless communication device **101** further includes a memory **116** which may include both read-only memory (ROM) and random access memory (RAM). A portion of the memory **116** may also include non-volatile random access memory to store information that must be present upon powering up the wireless communication device **101**. The memory **116** is used generally to store instructions and data for processing by the CPU **112**.

The wireless communication device **101** also includes an output data memory **118** that is devoted to storing information such as user programmable volume levels and the associated menu titles or labels for earpiece, ringer, key beep, and message alerts of the wireless communication device **101**. The output

data memory **118** may also store the identification data of an external accessory **201** connected to the wireless communication device **101**.

The wireless communication device **101** also includes an audio input device, such as a microphone **120**, and an audio output device, such as a speaker **122**. The microphone **120** and speaker **122** operate in a conventional manner to provide two-way audio communication using the wireless communication device **101**. The speaker **122** is driven by driving signals generated by an output driver **124**. The driving signals provided by the output driver **124** will be converted by the speaker **122** into audible signals to transmit the voice of the caller to the user, or produce audible cues that assist the user in operating the wireless communication device **101**.

The wireless communication device **101** also includes a display **126** to conveniently display user instructions as well as user-entered data, such as destination telephone numbers and alphanumeric text. The information shown on the display **126** provides visual cues that assist the user in the operation of the system **100**. A keypad **128** is attached to the housing **102** for operation by the user in a conventional manner. The keypad **128** provides a convenient input device by which destination telephone numbers and commands may be entered by the user.

The electrical components of the system **100** receive power from a battery **130**, which is attached to and supported by the housing **102**. In an exemplary embodiment, the battery **130** is a rechargeable battery. In other embodiments, the system **100** may include a connector (not shown) for the connection of an external power source, such as an automobile power adapter, AC power adapter, or the like.

The various components of the system **100** are coupled together by a bus system **132** of the wireless communication device **101**, which may include a power bus, control signal bus, and status signal bus in addition to a data bus.

However, for the sake of clarity, the various buses are illustrated in FIG. 1 as the bus system **132**.

External accessories **201** may be connected to wireless communication device **101** through an accessory port **136**. The external accessories are connected to the bus system **132** through the accessory port **136**. When connected to the wireless communication device **101**, the external accessory **201** allows the wireless communication device to be used in a wide range of applications. As shown in FIG. 2, the external accessory **201** has an extension cord **208**. A connector **209** at the end of the extension cord **208** allows the external accessory **201** to be coupled to the accessory port **136** of the wireless communication device **101**. In general, the external accessory **201** is manufactured by the same manufacturer of the wireless communication device **101**, thereby insuring compatibility between the two. However, it is also possible for an external accessory to be compatible with wireless communication devices made by other manufactures.

Some examples of the external accessories **201** are the headset accessory **202** and the carkit accessory **210**, which are illustrated in FIG. 2. The headset accessory **202** is useful because the user does not need to hold the wireless communication device **101** during operation. The mouthpiece **204** and earpiece **206** are positioned by the headset **201** accessory and are used in place of the microphone **120** and speaker **122** (see FIG. 1) of the wireless communication device **101** whenever the headset accessory **202** is connected.

The carkit accessory **210** is also useful because an external microphone **212** attached to the interior of an automobile is used in place of the microphone **120**, and the audible output signals produced by the wireless communication device are transmitted over an audio system **214** in the automobile. Thus, the user can use the wireless communication device and continue to drive using

both hands without any distractions from trying to hold the wireless communication device.

There are many other different types of external accessories available. The carkit accessory **210** shown in FIG. 2 is a non-coil-cord carkit, where the cord **208** connecting the external accessory **210** to the wireless communication device **101** is a straight cord. Other types of carkits are available where the cord **208** is a coil, such as those commonly used on conventional telephones. A battery charger that charges the rechargeable battery **130** in the wireless communication device **101** is another common external accessory. A computer interface for a personal computer or laptop is yet another possible external accessory that can be coupled to the wireless communication device **101** via the accessory port **136**. Illustrations of these other external accessories **201** are not shown or described in detail herein because they are familiar to those skilled in the art.

In order to support the operation of external accessory **201** and to update the user interface properly upon connection, the wireless communication device **101** needs to be able to identify external accessory **201** when it is first connected. The identification processor **114** does this by monitoring existing lines in the accessory port **136**. Extensions of these lines run through the cord **208**.

In an exemplary embodiment, the accessory port **136** is a pulse code modulation (PCM) port that transfers data between the wireless communication device **101** and the external accessory **201**. The PCM port has four lines or pins. One of the lines is a PCM-Data-In (PCM-DIN) line for the transmission of data from the external accessory **201** to the wireless communication device **101**. As will be described in further detail below, the identification processor **114** monitors this line for a voltage or status signal that indicates when an external accessory **201** is connected to the wireless communication device **101** and then for a device identification (ID) code of the external accessory **201**. The other

three lines in the accessory port **136** are a PCM-Data-Out (PCM-DOUT) line for transmission of data from the wireless communication device **101** to the external accessory **201**, a clock line, and a synchronization line. The PCM port can also have a fifth line for grounding. It is to be appreciated that in some embodiments, the PCM port can have more or fewer lines. For example, clock and synchronization signals could be transmitted over the same line. Power and signal ground can share the same line.

If the external accessory **201** has an external power supply that supplies power to the wireless communication device **101**, then a voltage level is detected by the identification processor **114** on a General Purpose Input/Output (GPIO) line of the wireless communication device **101**. The GPIO line can be a part of the PCM port, or it can be a line external to the PCM port lines described above. PCM is not described herein in detail because it is familiar to those skilled in the art.

In an exemplary embodiment, the PCM-DIN line remains at low logic level when there is no external accessory **201** attached to the accessory port **136**. Low logic level can be defined as either zero voltage level, a low voltage level, or a negative voltage level. Most external accessories, except for battery chargers, will transmit high logic level on the PCM-DIN line when the external accessory **201** is attached to the accessory port **136**. High logic level is defined to be a voltage level higher than the low logic level voltage. FIG. 3 is a table listing several external accessories **201** and whether a particular external accessory **201** inserts a high logic level on the PCM-DIN line upon connection. The information shown in the table of FIG. 3 for known external accessories is stored in the memory **116** or in the output data memory **118**, so that when a particular external accessory **201** is connected, the logic levels transmitted by the external accessory **201** are compared by the identification processor **114** with this known information.

Upon connection, the external accessory **201** transmits high logic level which may be in the form of pulses on the PCM-DIN line. The pulse width of low logic level is preferably set to be shorter than 50 milliseconds. The identification processor **114** is clocked to constantly monitor the PCM-DIN line in 50 millisecond intervals. If any high logic level is detected within this time interval, it indicates that an external accessory **201** has just attached to the wireless communication device **101**. Otherwise, there is no external accessory **201** connected. It should be noted that a battery charger may be connected to the accessory port **136**. Because the charger does not transfer data to the wireless communication device **101**, the logic level on the PCM-DIN line remains low, as indicated in the table of FIG. 3. A person skilled in the art would know how to program the identification processor **114** to monitor the PCM-DIN line during intervals determined by a clock.

Some external accessories **201**, such as the carkit **210** and a battery charger, also supply external power to the wireless communication device **101**. The table of FIG. 3 identifies the external accessories **201** that supply external power. The identification processor **114** detects the presence of a voltage level coming from an external power line through a detector connected to a GPIO line of the wireless communication device **101**. This voltage level, whether logic high or logic low, provides additional indication as to whether an external accessory **201** has been connected. For example, as shown in the table of FIG. 3, if the identification processor **114** detects both a low logic level on the PCM-DIN line and presence of external power, then it determines that a battery charger is connected. If the identification processor **114** detects the other combinations shown in the table of FIG. 3, then the identification processor **114** checks for a third set of information -- the device ID code of the external accessory **201** -- on the PCM-DIN line, as will be described below. Like the data on the PCM-DIN signal line, the external power information for known external

accessories, shown in the table of FIG. 3, is also stored in the memory **116** or in the output data memory **118**, so that the identification processor **114** can compare the transmitted information with the known information stored in the memory **116** or in the output data memory **118**.

Data transmitted by the external accessory **201** to the wireless communication device **101** along the data lines of the PCM port, including the device ID, are in a serial stream. In an exemplary embodiment, the PCM data runs at a data rate of 128K bits/second. Eight bits out of every 16 bits are used to carry Vocoder data, which are compressed samples of audio data or fax data, for example. The remaining 8 bits of the 16 bits are known as the "pad-byte" or "pad character." In system **100**, during the device identification the pad-byte is used to carry the ID information of the external accessory **201** during the communication interface between the external accessory and the wireless communication device **101**. The external accessory **201** places a unique value in this pad-byte upon connection to wireless communication device **101**. The unique value of the ID information is shown by the representative values listed in the table of FIG. 3. For example, the device ID of the headset **202** is C1 hexadecimal. These known values are also stored in the memory **116** or in the output data memory **118**, so that the identification processor **114** can compare the ID information actually received from the external accessory **201** with the known values to identify the external accessory.

Data communication through the PCM-DIN line is not always reliable. Noise on the PCM-DIN line can cause errors in the transmitted data, including the value of the pad-byte. To ensure that the correct pad-byte value is obtained, the identification processor **114** reads the pad-byte multiple times, with minimum delay after each reading, to make sure that the data is consistent. The identification processor **114** synchronizes the transmission and reading of the data by generating a clock signal. The delay between reading periods, as

defined by the clock signal, is 125 microseconds, which is the transmission time of each pad-byte. The external accessory **201** transmits the pad-byte data in response to receiving the clock signal. With this mechanism of repeatedly reading and comparing the pad-byte data, missed or skipped PCM samples do not affect the accuracy of the data value in the pad-byte.

The external power status signal on the GPIO line, the high logic level status signal and the device ID pad-byte data on the PCM-DIN line do not arrive at the PCM port at the same time. To support real-time operation of the wireless communication device **101**, the identification processor **114** processes the signals and device ID data based on logic states of the system **100**. That is, the identification processor **114** performs a particular function and remains in a predetermined state until directed to perform a different function and thereby change states. Software instructions, referred to as "keys," represent a change of states. For instance, a key may indicate that the identification processor **114** is toggling from monitoring for the high logic level status signal on the PCM-DIN line to reading the transmitted ID code. The table shown in FIG. 4 lists several representative keys and the corresponding status that the keys represent.

FIG. 5 illustrates a state machine flow chart **500** describing the operation of the system **100** using the keys listed in the table of FIG. 4 and the information shown in the table of FIG. 3. The encircled quantities represent different states of the system **100**. The directional arrows, showing the delivery of various keys, represent a change from one state to another. Operation of this state machine flow chart **500** will be explained below for the headset **202** and the non-coil-cord carkit **210**. The process to identify these two external accessories can be extended to identify the other external accessories listed in the table of FIG. 3. For example, the HS_EXT_POWER_ON_K key **510** indicates that external power from an external accessory **201** has been detected by the

identification processor **114** on the GPIO line. Based on this state, key **510** would then direct the identification processor **114** to change to the next state of monitoring for a high logic level on the PCM-DIN line. The keys listed in the table of FIG. 4 drive system **100** from one state to another and towards the state in which the external accessory **201** is fully identified.

Referring to FIG. 5 and choosing a state **130** as an initial state, the wireless communication device **101** is powered by the battery **130** if there is no external accessory **201** connected to the accessory port **136**. It is noted that a state **132**, indicated as LPM (Low Power Mode), could also have been chosen as an initial state, when there is minimum power being supplied to the wireless communication device **101**. In state **130**, the identification processor **114** monitors for both a high logic level on the PCM-DIN line and a voltage on the GPIO line that indicates an external power source. If high logic level is not detected on the PCM-DIN line but external power is detected on the GPIO line, a HS_EXT_PWR_ON_K key **510** is delivered to change the state of the system **100** from state **130** to state **550**. As indicated in the table of FIG. 3, the combination of an external power source and low logic level on the PCM-DIN line indicates that a charger is coupled to the wireless communication device **101**.

In the previous step, if the identification processor **114** does detect a high logic level on the PCM-DIN line, which indicates the connection of some type of external accessory **201**, then a HS_EXT_DEV_K key **504** is delivered to change the state of the system **100** from state **130** to state **552**. In state **552**, the identification processor **114** then checks for external power on the GPIO line. System **100** remains in state **552** if no external power is detected on the GPIO line, and checks for a device ID in the pad-byte of the data transmitted on the PCM-DIN line. From a review of the table of FIG. 3, this combination of high logic level on the PCM-DIN line and no external power on the GPIO line

indicates that there is a headset **202**, a computer interface, or an unknown device coupled to the wireless communication device **101**.

Next, if a pad-byte corresponding to hexadecimal ID C1, shown in the table of FIG. 3 for a headset **202**, is detected by identification processor **114**, a HS_HEADSET_K key **508** is delivered to change the state of the system **100** from state **552** to state **202**. Once this final identification is made, the wireless communication device **101** can properly interface with the headset **202**. In the previous step, it is to be appreciated that if a hexadecimal device ID 00 of a computer interface or an ID of an unknown device are detected instead of the hexadecimal device ID C1, then a HS_DOTG_K key **514** or a HS_DEV_UNKNOWN_K key **516**, corresponding to these two other devices respectively would have been delivered. As discussed above, identification processor **114** reads the pad-byte data repeatedly, as determined by the clock signal, to verify that there is no error in the pad-byte.

If, back in state **552**, the identification processor **114** had detected external power on the GPIO line, then an HS_EXT_PWR_ON_K key **514** would have been delivered. This key **514** would change the state of the system **100** from state **552** to state **554**. As will be described later below, at state **554**, identification processor **114** reads the device ID transmitted from the coupled external accessory **201**.

If the headset **202** is disconnected from accessory port **136** or if the headset **202** is disabled, a HS_PHONE_K key **506** is delivered to change the state of the system **100** from state **202** to state **130**. Key **506** changes the PCM-DIN line back to logic low so that identification processor **114** can monitor for the next connection. Key **506** is delivered whenever an external accessory **201** is disabled or disconnected from the wireless communication device **101**.

The procedure for identifying when an external accessory **201** with an external power source, such as the non-coil-cord carkit **210** shown in FIG. 2, is

connected to the wireless communication device **101** will now be described. State **130** in the flow chart **500** of FIG. 5 is chosen once again as the initial state of the system **100**, where there is no external accessory **201** connected and a battery **130** supplies power to the wireless communication device **101**. Upon connection of an external accessory **201** to accessory port **136**, the identification processor **114** detects external power on the GPIO line. From a review of the table of FIG. 3, this condition indicates that a battery charger, a computer interface, a non-coil-cord carkit **210**, a coil-cord carkit, or an unknown device, is supplying external power to the wireless communication device **101**. The HS_EXT_PWR_ON_K key **510**, shown at the top of FIG. 5, is delivered to change the state of the system **100** from state **130** to state **550**. The delivery of key **510** also simultaneously disables the battery **130**. Once in state **550**, the identification processor **114** then checks to see if the PCM-DIN line has high logic level. If high logic level is not detected on the PCM-DIN line, the system **100** remains in state **550**, signifying that a charger is connected to the accessory port **136** (see FIG. 3).

If, in the previous step at state **550**, high logic level is detected on the PCM-DIN line, then a HS_EXT_DEV_K key **505** is delivered to change the state of the system **100** from state **550** to state **554**. From a review of the table of FIG. 3, the combination of external power on the GPIO line and logic high level status on the PCM-DIN line indicates a connection of a carkit, a computer interface, or an unknown device. In state **554**, the identification processor **114** repeatedly reads for a device ID in the pad-byte of the transmitted data from the connected external accessory **201**, using the clock intervals discussed above.

It should be noted that, in the process described above at state **130**, the identification processor **114** first checked for external power on the GPIO line, and then subsequently checked for a high logic level status on the PCM-DIN line. In this fashion, the state of system **100** changed sequentially from state **130**,

to state **550**, and to state **554**. It is also possible to program the identification processor **114** to first check for the high logic level status on the PCM-DIN line before it checks for external power on the GPIO line. If identification processor **114** does this, the system **100** would change from state **130**, to state **552**, and to state **554**. The end result is the same—the system **100** is at state **554**.

Now referring to state **554**, if the hexadecimal ID C2 of the non-coil-cord carkit **210** is identified, a HS_HFK_NOCORD_K key **512** is delivered to complete the interface by changing the state of the system **100** from state **554** to state **210**. In the flow chart **500** of FIG. 5, state **210** is indicated as "HFK." HFK signifies a "Hands-Free Kit" for a carkit. It is to be appreciated that it would have been possible in state **554** to detect the device ID of other external accessories **201** that have an external power source and that transmit a high logic status on the PCM-DIN line. The corresponding keys for these external accessories **201**, as shown in FIG. 4, would have been delivered in place of HS_HFK_NOCORD_K key **512**.

Should the non-coil-cord carkit **210** or these other external accessories be subsequently disconnected from the wireless communication device **101**, a HS_PHONE_K key **509** and a HS_EXT_PWR_OFF_K key **502** are delivered, resulting in the system **100** sequentially changing states from state **210**, to state **550**, and finally to state **130**, where the phone battery **130** (see Fig. 1) resumes supplying power to the wireless communication device **101**. In state **130**, the identification processor **114** returns to the state where it monitors for high logic level status on the PCM-DIN line and for external power on the GPIO line.

It is to be understood that different external devices **201** can be connected to and disconnected from the accessory port **136** at any time period while the identification process of a previously connected external accessory **201** is occurring. FIG. 5 shows how the identification processor **114** processes these events. For example, if a headset **202** is connected while the identification

processor **114** is still in the process of reading the device ID of the headset **202** in state **552**, the user may suddenly disconnect the headset **202** and connect the carkit **210** to the accessory port **136**. The momentary disconnection of the headset **202** will result in a HS_PHONE_K key **507** being delivered to change the state of the system **100** from state **552** to state **130**. Once in state **130**, the identification processor **114** will detect external power on the GPIO line and start a new identification procedure for the carkit **210**, including the initial step of delivering the HS_EXT_PWR_ON_K key **510** to change the state of the system **100** from state **130** to state **550**. The process of identifying the carkit **210** then repeats as previously described above. The flow chart **500** of FIG. 5 illustrates how this and other identification processes can be accomplished, and a person skilled in art would understand how these processes are accomplished by reviewing the figure.

In an embodiment of the present invention, once the external accessory **201** is identified, the identification processor **114** provides appropriate instructions to the other elements shown in FIG. 1 in housing **102** so that the user can perform functions such as adjusting the volume levels of the wireless communication device **101** or any of the accessories **201** which may be coupled to the wireless communication device. For example, once the type of external accessory **201** has been identified, the identification processor **114** generates selection data to select the appropriate program volumes for the external accessory **201** or the wireless communication device **101**, which are stored in output data memory **118**. The information in the output data memory **118** determines the output level at which output driver **124** will generate driving signals to drive the corresponding output device. The display **126** shows the volume level and a label for the external accessory **201** corresponding to that volume level. The techniques used to determine how the identification processor selects programmed volume levels for adjustment and display on

display **126** are described in co-pending U.S. Patent Application No. 09/229,132, entitled "SYSTEM AND METHOD FOR A MENU TITLE DISPLAY IN A WIRELESS COMMUNICATION DEVICE," filed on January 12, 1999 and assigned to the assignee of the present application. This co-pending application is incorporated herein by reference in its entirety.

It is to be understood that even though various embodiments and advantages of the present invention have been set forth in the foregoing description, the above description is illustrative only, and reasonable changes can be made without departing from the spirit and scope of the invention. Accordingly, the invention is not to be limited by the foregoing description. Instead, the scope of the invention is to be determined on the basis of the claim or claims that follow, the interpretation of which are to be made in accordance with established doctrines of claim interpretation.

What is claimed is:

CLAIMS

1. A wireless communication system, comprising:

a housing;

a wireless communication device contained at least partially within the housing;

an accessory port mounted on the housing and accessible to an external accessory to allow the external accessory to be coupled to the wireless communication device, the accessory port including at least one data line; and

a processor communicatively coupled to the wireless communication device and to the accessory port to sense activity on the data line when the external accessory is coupled to the accessory port, the processor further sensing identification data associated with the external accessory and using the identification data to identify the external accessory.

2. The system of claim 1 wherein the data line is a portion of a pulse code modulation (PCM) port.

3. The system of claim 1 wherein the processor generates a clock signal coupled to the accessory port, the external accessory transmitting identification data to the wireless communication device over the data line in response to the clock signal when the external accessory is coupled to the wireless communication device.

4. The system of claim 1 wherein the accessory port further includes an input line to transmit a voltage from the external accessory when the external accessory is coupled to the wireless communication device, the voltage indicative of whether the external accessory provides external power to the wireless communication device.

5. The system of claim 1, further comprising a storage area associated with the wireless communication device to store codes corresponding to a plurality of external accessories, the processor comparing the sensed identification data with the stored codes to identify the external accessory when the external accessory is coupled to the wireless communication device.

6. The system of claim 1 wherein the external accessory is one of a carkit for use in an automobile having an audio system, a headset, or a computer interface, the external accessory transmitting an identification code as part of the identification data when the external accessory is coupled to the wireless communication device.

7. The system of claim 1 wherein the external accessory is a charger to supply power to the wireless communication device when the charger is coupled to the wireless communication device.

8. The system of claim 1 wherein the activity on the data line includes a signal transmitted from the external accessory to indicate when the external accessory is coupled to the wireless communication device.

9. The system of claim 3, further comprising a clock line coupled to the accessory port and to the external accessory, the wireless communication device transmitting the clock signal to the external accessory over the clock line.

10. A wireless communication device coupleable to an external accessory, comprising:

an accessory port to receive a data line attached to the external accessory to allow the external accessory to be coupled to the wireless communication device;

a processor to sense activity on the data line when the external accessory is coupled to the wireless communication device, the processor further sensing identification data associated with the external accessory and using the identification data to identify the external accessory; and

an output driver to generate output signals, the output signals being coupled to the external accessory via the accessory port when the external accessory is coupled to the wireless communication device.

11. The device of claim 10 wherein the activity includes a signal transmitted by the external accessory when the external accessory is coupled to the wireless communication device and the identification data includes an identification code of the external accessory.

12. The device of claim 10 wherein the data line is a portion of a pulse code modulation (PCM) port, and the PCM port is coupleable to the accessory port.

13. The device of claim 10 wherein the accessory port further includes an input line for transmitting a voltage indicative of whether the external accessory supplies external power to the wireless communication device when the external accessory is coupled to the wireless communication device.

14. The device of claim 10, further comprising a storage location coupled to the processor, the storage location storing data associated with a plurality of external accessories, the stored data including an identification code corresponding to any one of the plurality of external accessories, and the processor comparing the transmitted identification data with the stored data to identify the external accessory when the external accessory is coupled to the wireless communication device.

15. The device of claim 10 wherein the processor generates a clock signal, the processor reading the identification data transmitted by the external accessory during a period of time defined by the clock signal.

16. The device of claim 11 wherein the identification code is a binary number.

17. The device of claim 10 wherein the external accessory is one of a carkit for use in an automobile having an audio system, a headset, or a computer interface, the external accessory transmitting the identification data on the data line when the external accessory is coupled to the wireless communication device.

18. The device of claim 10 wherein the external accessory is a charger to supply power to the wireless communication device when the charger is coupled to the wireless communication device.

19. A method of determining when an external accessory is coupled to an accessory port of a wireless communication device and identifying the external accessory, the method comprising the steps of:

monitoring a data line for activity indicative of when the external accessory is coupled to the wireless communication device;

reading identification data transmitted by the external accessory on the data line when the external accessory is coupled to the wireless communication device; and

comparing the transmitted identification data with stored information associated with a plurality of external accessories to identify the external accessory.

20. The method of claim 19 wherein the step of monitoring includes checking an input line for a voltage indicative of whether the external accessory supplies external power to the wireless communication device.

21. The method of claim 19, further comprising the step of generating a clock signal, the monitoring and reading steps occurring in response to a period of time defined by the clock signal.

22. The method of claim 21, further comprising the step of sending the clock signal to the external accessory, the external accessory transmitting the identification data in response to the clock signal.

23. The method of claim 19, further comprising, repeating the reading and comparing steps to obtain a consistent identification of the identification data.

24. The method of claim 19, further comprising, repeating the monitoring step to detect when the external accessory is coupled or uncoupled from the wireless communication device.

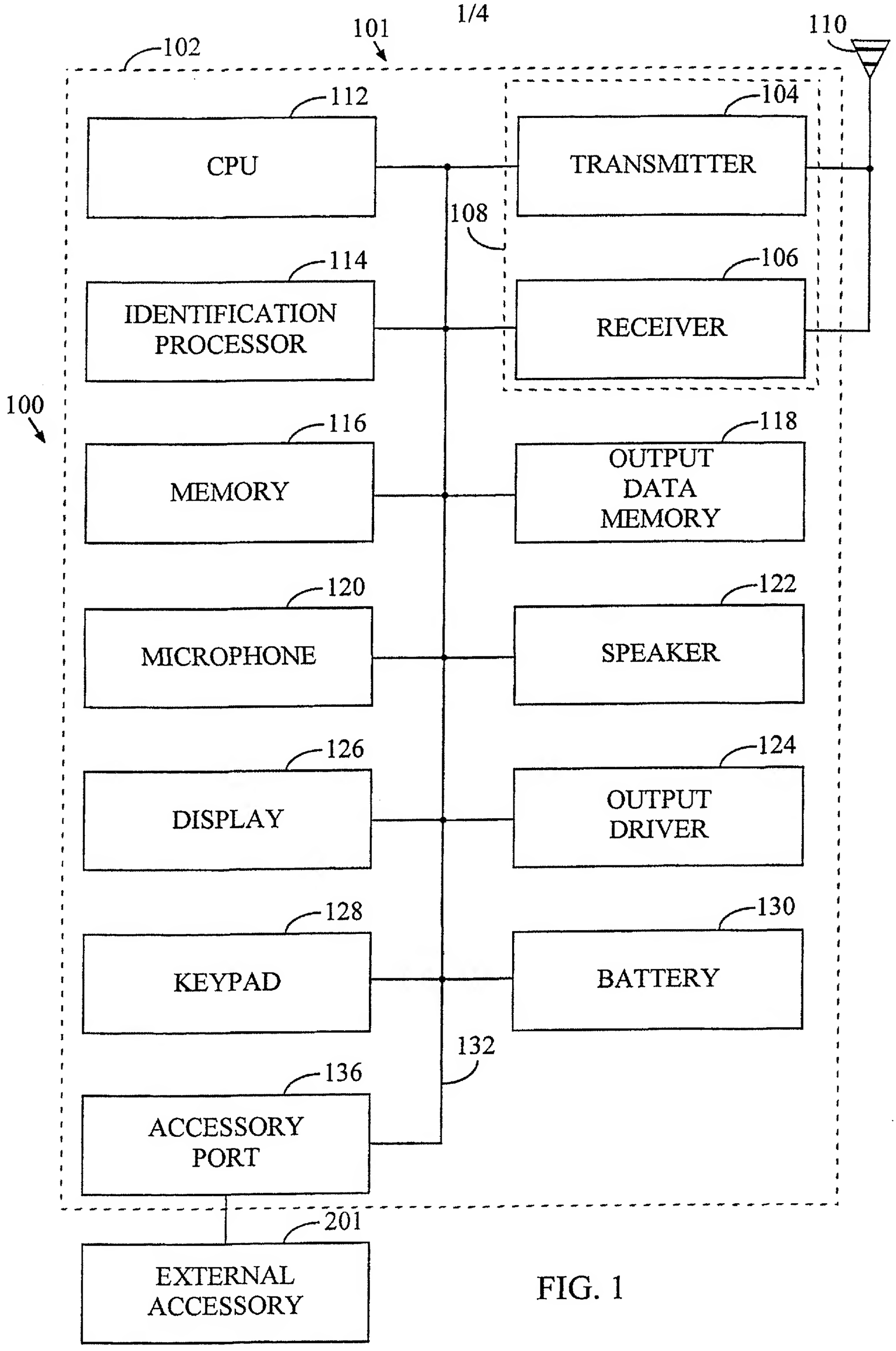

100
101
102
110
112
CPU
104
TRANSMITTER
108
114
IDENTIFICATION PROCESSOR
106
RECEIVER
116
MEMORY
118
OUTPUT DATA MEMORY
120
MICROPHONE
122
SPEAKER
126
DISPLAY
124
OUTPUT DRIVER
128
KEYPAD
130
BATTERY
132
136
ACCESSORY PORT
201
EXTERNAL ACCESSORY

FIG. 1

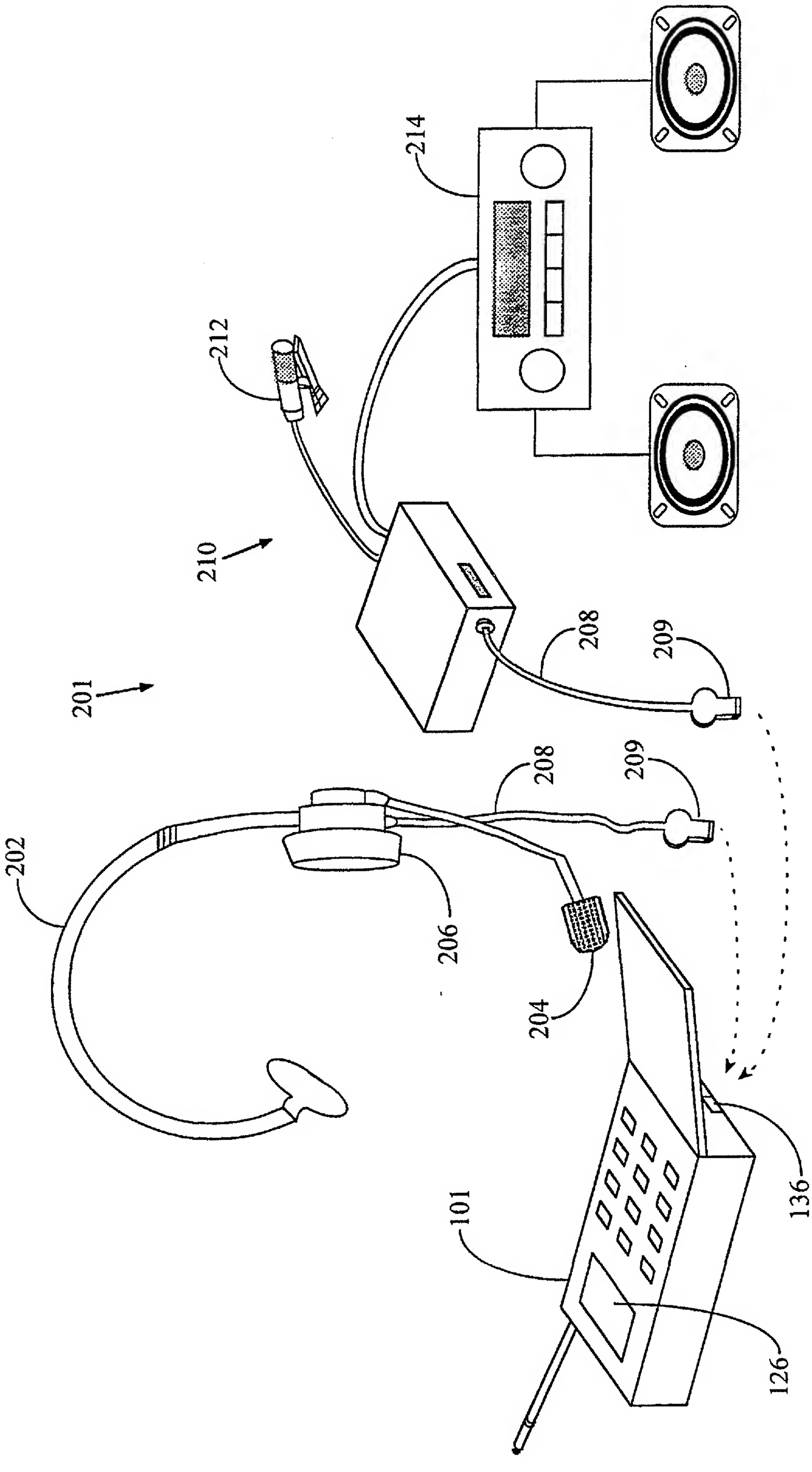


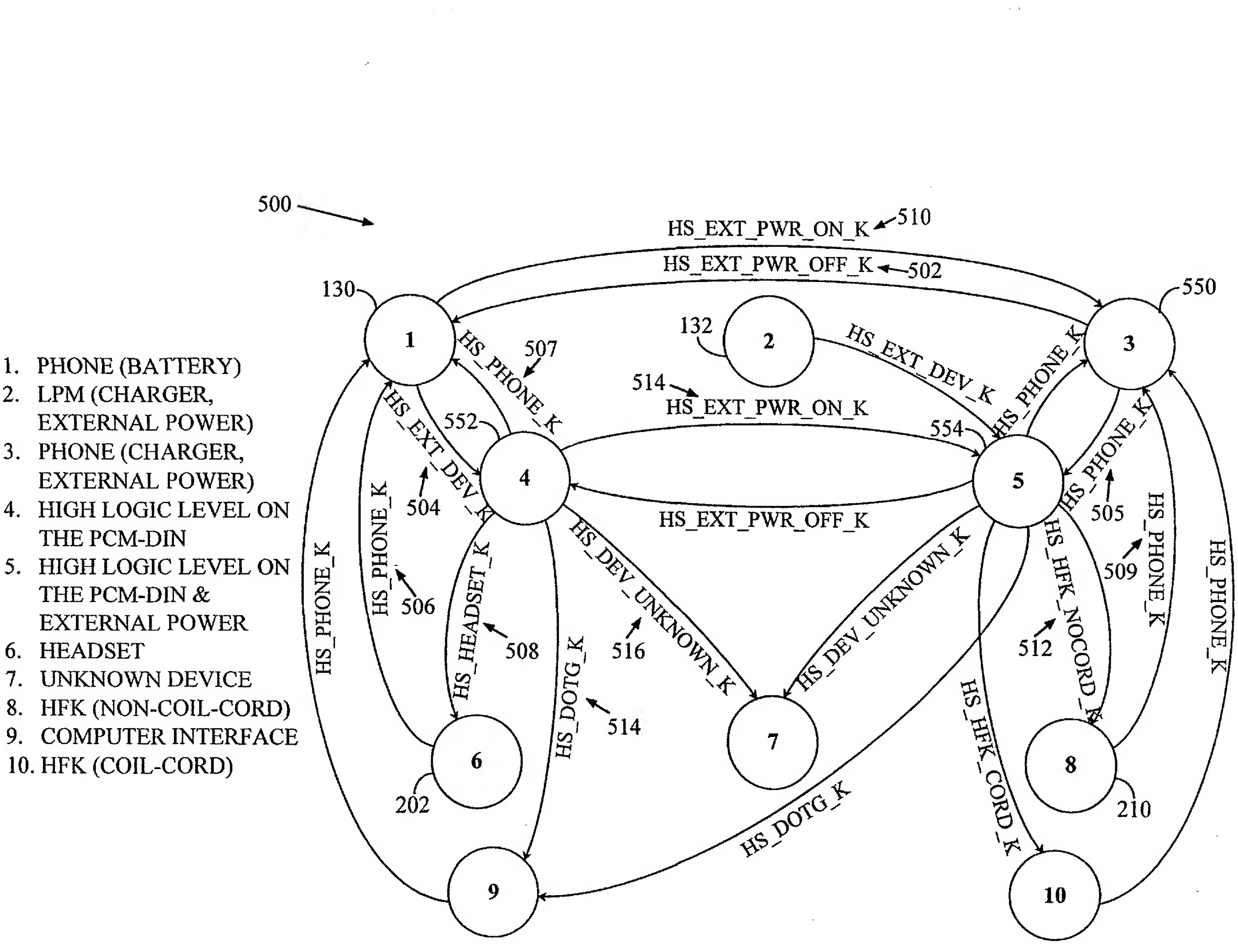
FIG. 2

DEVICE (201)	HIGH LOGIC LEVEL ON THE PCM-DIN	EXTERNAL POWER	DEVICE ID
COIL-CORD CARKIT	YES	YES	C3 HEX
NON-COIL-CORD CARKIT (210)	YES	YES	C2 HEX
HEADSET (202)	YES	NO	C1 HEX
COMPUTER INTERFACE	YES	YES/NO	00 HEX
CHARGER	NO	YES	NOT APPLICABLE
RESERVED			OTHER VALUES

FIG. 3

KEYS	STATUS
HS_EXT_POWER_ON_K	EXTERNAL POWER DETECTED
HS_EXT_POWER_OFF_K	NO EXTERNAL POWER DETECTED
HS_EXT_DEV_K	PCM-DIN LOGIC HIGH DETECTED
HS_PHONE_K	PCM-DIN CHANGED TO STAY AT LOGIC LOW
HS_HFK_CORD_K	COIL-CORD DEVICE ID
HS_HFK_NOCORD_K	NON-COIL-CORD DEVICE ID
HS_HEADSET_K	HEADSET DEVICE ID
HS_DOTG_K	COMPUTER INTERFACE DEVICE ID
HS_DEV_UNKNOWN_K	UNKNOWN DEVICE

FIG. 4



1. PHONE (BATTERY)
2. LPM (CHARGER, EXTERNAL POWER)
3. PHONE (CHARGER, EXTERNAL POWER)
4. HIGH LOGIC LEVEL ON THE PCM-DIN
5. HIGH LOGIC LEVEL ON THE PCM-DIN & EXTERNAL POWER
6. HEADSET
7. UNKNOWN DEVICE
8. HFK (NON-COIL-CORD)
9. COMPUTER INTERFACE
10. HFK (COIL-CORD)

FIG. 5

PCT/US00/00662

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 00/00662

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04Q7/32 H04B1/38 H04M1/60

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04M H04B H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0 861 009 A (NOKIA MOBILE PHONES LTD) 26 August 1998 (1998-08-26)	1,2,4-6, 8,10-14, 17,19,20
A	page 3, line 33 -page 8, line 48; figures 1-4	3,9,15
Y	US 5 797 102 A (HALLIKAINEN ET AL) 18 August 1998 (1998-08-18)	1,2,4-6, 8,10-14, 17,19,20
	the whole document	
A	WO 98 51016 A (ERICSSON TELEFON AB L M) 12 November 1998 (1998-11-12) page 5, line 10 -page 16, line 3; figures 1-3	1,6-8, 10,17,19

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 May 2000	06/06/2000
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Authorized officer Delangue, P

Ir ..ational Application No
PCT/US 00/00662

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 861 008 A (PHILIPS ELECTRONICS NV) 26 August 1998 (1998-08-26) column 2, line 44 -column 6, line 58; figures 1-6	1,6,10, 17,19
A	US 5 783 926 A (AGNOR ET AL) 21 July 1998 (1998-07-21) column 2, line 65 -column 4, line 55; figures 1-3	1,10,19
P,X	US 5 859 522 A (THEOBALD) 12 January 1999 (1999-01-12) column 2, line 4 -column 7, line 61; figures 1,2	1,7,10, 18,19

Information on patent family members

Ir. .ational Application No
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